

DESIGN FOR SMARTPHONES

Challenges in designing the User Interface and mobile websites

Research Project

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Introduction

In this research project I will be looking at what it is like designing for a new generation of mobile phones – smartphones. Specifically, I will be looking at two main areas of user involvement. The first one is the User Interface of a smartphone. After establishing and defining what a smartphone is I will be overviewing the most popular mobile operating systems and their respective interfaces on the market today. By means of comparison I will establish what the main features of each one are and what the differences between them mean in user interaction and how designers of different User Interfaces managed to convey the hierarchy and importance of information. I will also try to establish some general guidelines for User Interface design.

The second area I will be looking at in this research is designing mobile websites for smartphones. I will be looking at what does a mobile web designer needs to consider when designing websites, what are some constrains and informal guidelines to consider and what impact they make to the end user - does a smartphone user need a full (desktop) version of a website or a scaled down, mobile friendly one.

When it comes to designing a User Interface or a mobile website there are many variables to consider. I will be looking at how screen size and resolution, hardware capabilities, software and finally a new way of interaction influence and shape the design and the challenges a designer faces when designing either.

Smartphones are a very new and most importantly a very rapidly evolving industry so not many resources are in print. Most of those are out of date and irrelevant for this subject. I have managed to find a few new books on this subject but the majority of my resources come from the internet. These have been researched and contain accurate and current

information or general information about a certain area. I have done a lot of first-hand observations, exploring Apple iPhone 4 running iOS 4.2 and HTC Desire running Android 2.2 with SENSE U User Interface/custom skin. I have also drawn from my experience in designing both desktop and mobile websites.

Finally, the aim of this research is to identify what challenges a designer faces when designing either the User Interface or a smartphone friendly website and how overcoming these challenges result in a coherent and successful product for users.

What is a smartphone?

In recent years there has been an increasing number of devices in a new category – smartphones. According to The Nielsen Company (2010) “...29.7 percent of U.S. mobile subscribers now own smartphones that run full operating systems.”

So what exactly is a smartphone? “*Smartphones are converged devices that combine mobility, connectivity, and programmability.*” Anon(2005). In layman’s terms they are mobile phones that let you do smart things. They give a user the ability to check and write email, retrieve information from the internet, watch movies, listen to music, create and edit documents, et cetera. Smartphone is a device “...*that lets you make telephone calls, but also adds features that you might find on a personal digital assistant or a computer.*” Cassavoy (n.d.).

Although there seems to be no standard definition of the term 'smartphone', there are common features that can be found on each one.

Smartphones have bigger screens and resolutions than found on standard mobile phones. A large screen makes it easier to perform various tasks. They are also faster and have more memory capacity to store and run various applications. The thing that also defines a smartphone is the availability of third-party applications that add functionality. That brings us to the operating system. A smartphone has an advanced operating system and on top of it it has a custom User Interface. To operate a smartphone a user normally uses finger touch and a QWERTY keyboard that can be either physical or software (on-screen). A smartphone can also run multiple applications at once and has internet connectivity, a USB connection as well as a high definition camera. (Anon, n.d.)

More about different types of smartphones, their underlying operating systems and variations of different User Interfaces in the following chapter.

Smartphone choices

As mentioned before, smartphones occupy a significant portion of the total mobile phone sales. It is safe to assume that each mobile phone manufacturer has one smartphone on the market. Because there are so many different manufacturers and since a manufacturer might make devices with two different operating systems, division by manufacturer is not appropriate.

Instead, it is best to divide smartphone devices by operating systems they run. Here, there are two instances. Firstly, there are Apple, RIM, Nokia and Palm which have their own operating systems that one will only find on the smartphones they make. iOS is exclusively run on Apple devices, Blackberry OS on RIM devices, Symbian on Nokia devices and webOS on Palm devices.

Alternatively, other manufactures use either Android, a Google developed operating system or Windows Phone 7 OS, a very recent evolution of Windows Mobile by Microsoft. (Anon., n.d.).

Each of these operating systems has its own User Interface or interfaces on top that provide users with a different experience when interacting, simply because each User Interface has specific characteristics. What follows is a brief overview.

Overview of mobile operating systems and their User Interfaces

Apple iOS

Apple iOS runs only on Apple built devices. In addition to their iPhone smartphone it runs on iPod and iPad. At the moment, iOS is in its fourth generation and able to run on three hardware generations of iPhone smartphones, with varying amount of features available. iOS has a touch based User Interface with a software, on-screen QWERTY keyboard. It consists of system and third-party applications which are launched from a grid based icon systems. (Apple Inc., 2010)

Android OS

Opposite of iOS, Google-built Android OS is available on open source which means that it runs on a wide range of devices built by various manufacturers. There are various versions of the operating system available and it is up to the manufacturer to decide which version is best suited for their device. Most manufacturers also apply their own User Interface, most notably MOTOBLUR by Motorola and SENSE UI by HTC. Despite that, Android OS is a grid based icon arrangement of system and third-party application launcher on various home screens, similar to iOS. Interaction is possible either by touch and by a software on-screen or a hardware keyboard. (Google Inc., n.d.)

Symbian OS

Symbian OS runs almost exclusively on Nokia devices. It is not considered as a smartphone OS since it runs on a large number of standard mobile phones. It differs from iOS and Android in that it was not designed with touch interaction in mind. However it does run on some new Nokia smartphones. It has very little third-party applications.

(Symbian Foundation, 2010)

BlackBerry OS

BlackBerry OS runs only on BlackBerry devices. It has a small number of third-party applications and interaction is a combination of a physical keyboard and trackball and touch for newest models. By appearance it is a mixture of grid based icon arrangement found in iOS and Android and menu based Symbian OS. (Research In Motion Limited, 2010)

webOS

Built by Palm for their own devices it is an operating system that was designed for touchscreen devices. In appearance it is similar to iOS and Android. However, it launches applications in card system which simplifies managing multitasking. It has a small number of third-party applications. All devices with webOS have a physical keyboard. (Palm Inc., 2010)

Windows Phone 7 OS

An evolutionary step from Windows Mobile OS it offers a unique visual experience and interaction. As oppose to static icon-filled screens found on most other mobile operating system User Interfaces, here the main screen is a selection of 'live tiles' which update themselves with content relevant to user selection. In addition it has a text only menu selection and a fast growing base of third-party applications. (Microsoft, 2010)

From this brief overview it becomes evident that there are many differences in User Interface design. Coupled with a large variety of hardware capabilities, they provide a challenge for User Interface designers and of course mobile web designers. More on that in the coming chapters.

Is having a lot a lot of choice a bad thing?

Choice was never bad when it comes to end users. There is a general tendency in people to compare one thing to another and then decide based on their preferences. Choice also spurs competition and further development. On the other hand a lot of choice for end users is a nightmare for User Interface designers. A User Interface is “...*way a program presents itself to a user, what it looks like on the screen, the commands it puts at his/her disposal, or the level at which he or she can communicate...*” Hickey (2010).

A User Interface should be able to communicate at optimal level the capabilities of the handset with minimal effort on the user side. If a User Interface is designed for one type and size of smartphone handsets it is quite different than having to design one for a variety of handsets with different hardware capabilities. In the following chapters we will have a look at the various User Interfaces and the physical constraints they have to conform to.

Smartphone User Interface

According to Williams (2010), *“The smart phone is not a phone. It's a computer. It's like your desktop or laptop. It stores data. It connects to the Internet. It runs applications. It's a computer, not a phone.”* While that may be true of smartphone capabilities, it is not true of its form and the way it is controlled. When it comes to form it is clear that smartphones are smaller than computers. But the biggest difference is that smartphones are controlled by touch instead of a mouse cursor. A finger is bigger than a cursor and inversely the screen on a smartphone is smaller. *“Everything needs to get a little bigger, and move further apart. This is the basic premise of being 'finger-friendly'.”* Williams (2010)

While this might sound a simple solution there is more to a User Interface than this. Since the screen is smaller not all information can be displayed simultaneously. It is important to understand that the desire is to accomplish the task in simplest and quickest manner, hence the importance of specific information being displayed in relation to a specific context. There are certain elements to a good smartphone User Interface. According to Pettinati (2007) these are: *“...Feature sets are optimized to streamline common use cases...”*, meaning that certain information and controls are only displayed when needed and thus not taking up unnecessary space on the screen. *“...Use typography to show hierarchy and importance...”* incorporates the idea of taking typography attributes such as style, colour, weight and size to distinguish different pieces of information without having to label it. *“...Large buttons are used to make interactions actionable...”* While computers are generally used indoors and with a cursor, smartphones are used in various conditions and during activities, like walking which emphasizes the importance of having a large clickable area to trigger the action.

These are some simple guidelines for designing a smartphone User Interface, but there are also physical variables of a handset to consider and making the design work.

Screen size and resolution

Screen size and corresponding screen resolutions are one of the most important characteristics users look at when deciding between smartphones. For one simple reason: larger the area and higher the resolution the more things one can see on a screen and in better detail. It would be easy if a specific User Interface were designed for only one screen size and one resolution. Let us see how the most widespread mobile operating systems fair on devices.

Firstly let us look at Apple`s smartphone iPhone and the current operating system iOS 4.2 which at this moment runs on three generations of iPhone: 3G, 3GS and iPhone 4. Apple has decided to keep the same screen size of 3.5 inches across the generations while only increasing the screen resolution. iPhone 3G and 3GS had the same resolution of 320pixels by 480pixels with the pixel density of 163 pixels per inch. With the iPhone 4 they doubled the screen resolution to 640 pixels by 960 pixels and pixel density to 326pixels per inch. (Cell phones etc., 2010)

While they kept the same design of the User Interface they could not have left everything as it was. If they had kept the icons at the same resolutions they would look very pixelated when blown up or twice as small if left in their original size. What they had to do was to increase the size from 57pixels to 114 pixels, which obviously also means that application developers must include two sets of icons for the iPhone smartphones.

Apple only runs iOS on their devices so they have a tight control on every aspect of their User interface which results in a smooth running, optimised and unified visual experience.

On the other hand, Google built Android OS on open source platform and hence it is freely available to manufacturers of handsets. What that means is that Google develops the operating system and basic User Interface called 'stock Android' to go with it. Stock Android is in essence very similar to iOS in its grid-based icon system but it also introduces some new features such as widget framework for displaying data without launching an application and a status bar for notifications. (Whitwam, 2010)

This stock Android is then available to manufacturers who either put it on their devices as it is or they put their own User Interfaces on top of it. Most notable ones are MOTOBLUR by Motorola and SENSE UI by HTC. Even with those custom User interfaces the 'android experience' remains in essence unchanged. What it changes is the visual consistence of the User Interface, because you have the system applications which are in tune with that custom skin and then third-party applications which are a mixture of developer`s own design and stock android functions.

Another dissimilarity with Apple`s iOS is the range of devices Android runs on. Where iOS has three device configurations, Android runs on countless. Even with a custom User Interface, for example SENSE UI by HTC, it still runs on devices ranging from 4.3 inch screen size and 800 pixels by 480 pixels resolution to 3.2 inches and 320 pixels by 240pixels. That creates a lot of compromise between making buttons and other elements too big on small screens and too small on large screens. It also makes it difficult for developers to design and develop applications which often results in some applications not being able to run on smaller devices. (Mies, 2010)

Similar to Apple, RIM who produce BlackBerry OS and devices, Palm who develop webOS and Nokia who use Symbian on their devices, all of them have a tight control on their respective User Interfaces which enables them to optimise the software for average hardware capabilities of their smartphones. (McCracken, 2008)

Microsoft however chose a different path. They have developed the operating system and the User Interface and then made it available to manufacturers. Contrary to Android, Windows Phone 7 OS requires the devices to have a specific minimum screen resolution and other physical features. That enables Microsoft and third-party developers to create a coherent User Interface experience (Microsoft, 2010)

Hardware buttons and keyboard

When it comes to other features that define various smartphones is the addition or lack of hardware buttons and a choice between a full QWERTY physical keyboard and an on-screen one. Not only is it a user preference choice it also reflects on the design of the User Interface. Again, let us have a look at the major mobile operating system User Interfaces.

Historically, Apple's iPhone has never had a physical keyboard and it only has one hardware button to aid navigation. That has enabled them to streamline the User Interface for onscreen keyboard use. However, as the iPhone only has one hardware button, the User Interface has to show other commands that could have been assigned to other hardware buttons which results less screen area available for content. For third-party users that means adding buttons or commands for back and search for example. (Apple Inc., 2010)

Android OS on the other hand has a variety of different hardware combinations, as it is up to manufactures to decide what their smartphone might have. There are however some compatibility guidelines which state that “...*The Home, Menu and Back functions are essential to the Android navigation paradigm. Device implementations MUST make these functions available to the user at all times, regardless of application state...*” Google Inc. (2010). This usually means that most Android-powered smartphones have at least those three hardware buttons, sometimes more, allowing designers to attach various User Interface elements to those buttons, freeing up space on the screen. But when it comes to keyboards there are no guidelines so the User Interface must accommodate either for an on-screen keyboard that takes up screen space and requires a subset of commands or a physical one which has dedicated keys.

Other operating system such as BlackBerry OS, webOS and Symbian OS all of which run exclusively on devices built by their developers have a combination of a touch interface and hardware keyboard. Because of their exclusivity they are all streamlined to work on generally smaller screens and a fixed set of hardware buttons. (Cell phones etc., 2010)

Microsoft on the other hand is licensing Windows Phone 7 operating system to manufacturers. They however have strict guidelines for which hardware buttons a device must have. Start, Search and Back button are a requirement. Similar to Android powered devices a keyboard can either be physical or on-screen. (Microsoft, 2010)

Processor/ Device Speed and Memory

An important smartphone feature is also a fast processor and large memory capacity, simply because a smartphone is designed to do so much more than just calls and texts.

Watching videos, listening to music, playing games and running other applications all demands fast hardware. Nevertheless, they are not the only reasons. All of the operating systems have User Interfaces which include a large number of animations found in left/right/up/down navigation, fade-in/fade-out transitions, zoom in /out of maps and content just to identify a few. In addition to handling running multiple applications a User Interface needs to be quick and responsive.

iOS, webOS, BlackBerry OS and Symbian all run exclusively on selected hardware and are therefore optimised to ensure they handle most user scenarios. Windows Phone 7 OS has specific requirements set out which a device manufacturer has to meet. This insures that the Users Interface runs as smooth as intended. (Cell phones etc., 2010)

Android OS however is a different story. Because there are many different builds of Android OS and each of them has a set of minimum hardware requirements, sometimes manufacturers put a version on their device which barely meets the requirements. This then results in a sluggish, barely responsive User Interface. Consequently, designers and developers struggle to create applications that run smoothly and take full advantage of features that come with certain OS versions. (McCracken, 2008).

Designing a coherent, well running and overall successful User Interface requires deep consideration of various parameters, not necessarily all in the domain of the User Interface designer. A combination of well thought-out software and high-end hardware is essential. For designers there are however some informal recommendations for designing a User Interface. According to Isaković (2010) they are: “...*Metaphores...*”, for example people are used to folders for putting documents in. Can also be used for actions such as sliding and flipping. “...*User Control...*”, where users and not applications have control

over actions. A good User Interface will suggest actions but always allow the users to change and warn them about the consequences. “...*Direct manipulation*...” is to give users a chance to manipulate objects on-screen thus engaging them more. A great example is flipping pages in a book reader. Users should also receive “...*Feedback*...” to assure them that they have done something and it has been registered. A colour change on button press would be an example of that. A User Interface should also have “...*Consistency*...” so that users can transfer skills and knowledge between applications, for example having an exit button always in the top right corner. Finally, a part of every User Interface should be “...*Aesthetic Integrity*...”. What it means is that the appearance should reflect the function. An application for productive tasks should not feature prominently decorate elements, but emphasize productive tools. Conversely, users expect a game to be design beautifully. Keeping these recommendations in mind should results in a successful User Interface design.

From the world of internal to the world of external

Designing an appealing, coherent and well performing User Interface is an attractive prospect, which is sadly reserved for mobile operating system developers or device manufacturers. The closest outside designers can get to influence User Interface is designing a mobile application for a smartphone.

However, what smartphones are designed for is connectivity. They are able to access content on the web at all times. The performance and outlook of a particular website ceases to only rely on the device. Instead, it is up to web designers to create engaging and mobile friendly websites. At this point it is important to establish the term “mobile website” in context of this research.

In general a mobile website is a scaled-down, adapted version of a standard desktop website. It is designed to accommodate a large variety of mobile devices with varying capabilities. (Firtman, 2010, p. 61)

Because the field of mobile devices is rather large and includes standard mobile phones, low and midrange mobile devices with basic internet access, non-phone devices like iPod Touch, e-book reader like Kindle and tablets such as iPad and Samsung Galaxy Tab and of course smartphones, it is important to stress that we will be looking at designing mobile websites for smartphones. (Firtman, 2010, p. 6-11)

But even when it comes to designing websites for smartphones, there are some considerations to be made which include hardware capabilities and software limitations, all of which make designing a challenge. In the following chapter we will have a look at some.

Designing smartphone mobile websites

Screen size and resolution

When considering designing a mobile website it is important to consider the physical size of the screen. While in desktop design we talk about 15 to 24 inch screen sizes (and more) in mobile design we think about 3 to 4.3 inch screen sizes and that's a big difference. The same goes for screen resolution, which "*...is the primary concern in mobile design. How many pixels (width and height) are available on a given device?...*" Firtman (2010, p.12). The combination of both gives us the pixel density "*PPI (pixels per inch) or DPI (dots per inch)*" Firtman (2010, p.12), which is just as important because a large screen with a small resolution is no better than a small screen with high resolution if text size is not increased.

As we have looked at earlier, there are countless smartphones with different screen sizes and screen resolutions. The current iPhone model has a resolution of 960pixels by 640 pixels and a pixel density of 326PPI. The other popular models 3G and 3GS have a resolution of 320 pixels by 480 pixels with 163 PPI pixel density. All have a screen size of 3.5 inches. (Cell phones etc., 2010) The range on Android OS powered smartphones is even bigger ranging from 3.2 inches with 320px by 240px to 4.3 inches with 854px by 480px. Symbian, webOS and Blackberry OS powered devices generally have smaller screens with midrange screen resolution. (Cell phones etc., 2010)

What it means is that a mobile website must accommodate the entire range of screen sizes and resolutions. The danger is that on a large screen with high resolution a website would

be visible in its entirety but the text would be small, whereas on a small screen with low resolution text would be bigger but not all of the page would be visible.

Software browser capabilities

When it comes to designing mobile websites a designer encounters the same issues that are present in designing websites for desktop computers. There are many different browser engine variations across all mobile operating systems and not all support the same set of features, although in general all smartphone browsers support the basic hypertext mark-up language (HTML) and cascading style sheets (CSS) which are used for designing basic websites. (Cell phones etc., 2010)

One of the most popular browser engines is WebKit. It is found in desktop browsers such as Chrome and Safari as well mobile browsers on all major smartphone operating systems. (The WebKit Open Source Project, n.d.) However, there are visible discrepancies when it comes to recognizing and supporting certain events and selectors. (Koch, 2010)

That poses a major issue for designers as they are unable to design advanced websites with coherent user experience for all smartphone users.

There are even differences between high-end smartphone devices. For example latest iPhone with iOS 4.2 is unable to play Flash content within the browser whereas an Android OS powered device running the latest 2.2 version can. (Anon., 2010) This forces designers to provide a fall-back for Flash content in the form of HTML 5 content.

Mobile browsing experience

It is important to understand that browsing websites on a smartphone is very different from desktop computers. Instead of a mouse cursor, navigation is done via touch, so it is important to have clickable elements of the correct size. The zoom experience is also different, because the browser reflows text to fit the new area. *“Always remember the 80/20 law: 80% of your desktop site will not be useful to mobile users. Therefore, you need to research the 20% you should be focusing on.”* Firtman (2010, p.61)

Full desktop experience versus mobile experience

Majority of smartphones that are on the market today are able to display full desktop websites and users demand equal experience on a mobile website as they have on their desktops. *“Some statistics even indicate that users tend to choose web versions over mobile versions when using a smartphone.”* Firtman (2010, p.2)

This could be because of two reasons. Firstly, it might be because we are so used to viewing desktop websites that we do not care about zooming in and out and scrolling left or right to find the information we were looking for. On the other hand it could be because the mobile versions were awful in the sense that they had very little information displayed on them and even that was just a number of text links. While that might have sufficed for a mobile website couple of years ago, it is not what smartphone users want today.

There is also a question of data consumption and bandwidth. It is true that a defining feature of a smartphone is connectivity and all smartphone have mobile internet (3G) and WIFI. (Cell phones etc., 2010) While the latter might not be available everywhere, mobile internet coverage becomes even scarcer when venturing outside major cities into the countryside. More importantly however, not all users are on unlimited data plans and wish to use as little data as possible. A slow data transfer and page loading also deters users from visiting again.

Even though mobile web has the same basic structure and uses the same basic technologies as the desktop one, there are differences in the way it is viewed at experienced. Smartphones have smaller screen sizes and resolutions than desktop

computers and if you combine that with touch interaction and multiple hardware capabilities it suddenly becomes a huge challenge to design cross-platform smartphone friendly websites that appeal to most users.

When designing mobile, smartphone friendly websites a web designer should consider some informal, but very useful guidelines. Most common and repeatedly mentioned, summarized by Appnovation Technologies (2010) are the following.

“Page content” should be prioritized, because most users are looking to find specific information. That information should also be divided ... *“into usable but limited size portions...”*. Large pages take time to load and that takes up data. It is important to remember that not all users are on unlimited data plans. Conversely, short pages require more requests and take up even more data. The page length is difficult to judge because of different screen resolution and some *“...scrolling...”* is inevitable. It should, however be simple. Most mobile websites scroll vertically and elements are stacked in that way. Horizontal scrolling should be avoided because a lot of browsers do not show horizontal scrollbars until a user tries to scroll. There is a danger that users won't immediately notice that there is additional content available with horizontal scroll and will therefore miss out on content.

In order for users to find information quickly, *“...Navigation...”* is of real importance. Important navigational elements such as menus, back buttons, search, et cetera should be clearly visible. They should not however take up a lot of space, pushing main content far down the page that requires a lot scrolling to view it. However, clickable objects should be large enough to be easy to press. It is worth to remember that screens on smartphones are small and some people have larger fingers, which makes pressing small buttons a pain without additional zooming. Ensuring that is *“...essential in streamlining the experience.”*

Dawson (2010). Navigation should also not be repeated in its entirety on every page, but should be contextual, showing only relevant links. It is important to reduce “...*the amount of clicks required to achieve an action...*” Dawson (2010), because it delays the content delivery which does not aid good User Experience.

Since smartphones are used in various conditions, sometimes where screen brightness is an issue, special attention should be placed on “...*Colour...*”. There should be a decent contrast ratio used in the colour scheme. The use of blue and purple for text should be avoided, as some mobile browsers do not underline hyperlinks, so it would be very hard to distinguish text from hyperlinks.

The use of “...*Background Images...*” should be avoided if unnecessary. They might cause contrast issues on some devices. In general, the use of images on mobile websites should be well thought-out. Images should not be large because they take a long time to load and take up valuable data. They should also be used only where contextually relevant.

There are also a lot of “...*Content Types...*” that should be avoided on mobile websites. Flash content is not supported on most smartphones, apart from those running the latest Android OS. Audio and video should be optimised and should not play or download automatically. The use of web scripts such as JavaScript and AJAX should also be avoided or used only for enhancing and not primary for displaying data as they are not well supported on a lot of smartphones.

Considering all the above mentioned guidelines it is important to ensure that mobile websites are written in correct language syntax, they take up as little space as possible and load as fast as possible. “*With caps, costs and speed issues, the need to keep markup as clean, small and standards-based as possible is important.*” Dawson (2010). Only then should a designer consider enhancing the content delivery for those smartphones that support it.

Conclusion

In the course of this research I have had a look at multiple online and some print sources on User Interface design and designing mobile websites for a new category of devices, called smartphones. As data included in the research shows, smartphones occupy a third of the total mobile phone sales at the moment with an ever increasing share. What makes a phone a smartphone is the hardware characteristics combined with an advanced mobile operating system. After establishing the definition of a smartphone I had a look at the mobile operating systems and the range of devices they run on. By looking at the features of each individual operating system and its corresponding User Interface(s) I was able to give a short overview.

As I had a look at the hardware characteristics, in particular the screen size, screen resolution, device`s speed and memory capacity and the presence or lack of hardware buttons and physical keyboards, I was able to tie those characteristics to the way a particular User Interface is designed and how it interacts with the user. I was able to analyse the weaknesses and strengths of particular User Interfaces and how they manifest in user interaction. After establishing that I was able to look at some guidelines User Interface designers should consider when designing. Those are some informal guidelines which can be applied across all mobile operating systems and regardless if a device is touchscreen only or has a physical keyboard.

In the second part of the research I had a look at the state of mobile web design in particular to smartphones as there a many other mobile devices able to view the web. I again had a look at screen size and resolution and their impact on mobile web design. Additionally, I had a look at the software browsers installed on various mobile operating

systems. I was able to point out some problems with how some browsers do not recognize certain elements which makes it difficult to truly design cross-platform.

Because smartphones are mostly able to display full desktop versions of websites, I pointed out pros and cons of smartphone friendly mobile websites and listed some arguments why a mobile version is more suitable for a smartphone, not only because of the physical characteristics but also because of other factors of mobile telephony. In the closing part I was able to establish some, again informal but widely accepted guidelines. Considering those will provide a framework for mobile websites designed in such a way that they deliver the best mobile experience without any shortcomings in comparison to desktop websites.

This research was to show differences in User Interface Design and smartphone mobile web design and how these differences provide challenges for designers. By exploring these differences I was able to give some common guidelines for future design considerations.

And finally what does the future bring for smartphones? The current trend is for devices to get bigger, faster and packed with more features. For User Interface designers that means more complex User Interfaces and as devices get bigger screens or bigger screen resolutions, User Interfaces will have to become more versatile. On some mobile platforms there will inevitably have to be some unification of interfaces (Android OS).

As for mobile web design is concerned there has lately been a new phenomenon called 'application of the web'. What it means is that mobile websites for specific interests such as Ebay, Amazon, New York Times, et cetera have become applications for specific mobile operating systems. By creating application designers have taken the advantages of the

mobile platform`s features to deliver their content in a more streamlined and visually enhancing way. Because each platform has different features the User Experience is different. However, until mobile web design fully embraces desktop web design technologies and mobile software starts fully supporting those features for touch interfaces, a dedicated mobile application will still offer better and more coherent User Experience. By 'applifying' the mobile web content, design has been taken from the realm of a web designer into the realm of a User Interface designer.

Reference list

Firtman, M., 2010. *Programming the Mobile Web*. Sebastopol: O`Reilly Media

Anon., 2005. *What is a smartphone?*. [Online] (Updated August 23 2008) Available at: <http://www.oreillynet.com/wireless/2005/08/23/whatismartphone.html> [Accessed 2 September 2010].

Anon., n.d. *Guide to comparing smartphone handsets*. [Online] (Updated n.d) Available at: <http://www.broadbandgenie.co.uk/smartphones/help/smartphone-comparison-guide-devices-handsets> [Accessed 26 October 2010].

Anon., n.d. *Buyers' Guide: How to Choose the Best Smartphone*. [Online] (Updated n.d) Available at: <http://www.broadbandgenie.co.uk/smartphones/> [Accessed 26 October 2010].

Anon., 2010. *iOS 4 vs Android 2.2 – War is Over*. [Online] (Updated June 22 2010) Available at: <http://www.taranfx.com/iphone-4-vs-android-2-2> [Accessed 28 November 2010].

Apple Inc., 2010. *iPhone*. [Online] (Updated n.d.) Available at: <http://www.apple.com/iphone/> [Accessed 1 November 2010].

Apple Inc., 2010. *iOS 4.2 Software updates*. [Online] (Updated n.d) Available at: <http://www.apple.com/ios/> [Accessed 18 November 2010].

Appnovation Technologies, 2010. *Guidelines for Adapting Web Site Designs for Mobile Delivery*. [Online] (Updated March17 2010) Available at: <http://www.appnovation.com/guidelines-adapting-designs-mobile-delivery> [Accessed 13 November 2010].

Dawson., A., 2010. *Mobile Web Design: Best Practices*. [Online] (Updated August 18 2010) Available at: <http://sixrevisions.com/web-development/mobile-web-design-best-practices/> [Accessed 26 November 2010].

Cassavoy, L., n.d. *What Is a Smartphone?*. [Online] (Updated n.d) Available at: http://cellphones.about.com/od/glossary/g/smart_defined.htm/ [Accessed 21 September 2010].

Cell phones etc., 2010. *Cell Phones / Compare* [Online] (Updated n.d) Available at: <http://www.cellphones.ca/cell-phones/compare/787,807,1190,1555,1597/> [Accessed 28 September 2010].

Google Inc., 2010. *Android 2.2 Compatibility Definition*. [Online] (Updated n.d) Available at: http://static.googleusercontent.com/external_content/untrusted_dlcp/source.android.com/en//compatibility/android-2.2-cdd.pdf [Accessed 30 November 2010].

Google Inc., n.d. *Android Developers*. [Online] (Updated n.d) Available at: <http://developer.android.com/index.html> [Accessed 19 November 2010].

Hickey, R., 2010. *Key terms in corpus processing*. [Online] (Updated August 2010) Available at: http://www.uni-due.de/CP/key_terms.htm [Accessed 27 October 2010].

Isakovič, J., 2010. *10 nasvetov za dober uporabniški vmesnik*. [Online] (Updated July 7 2010) Available at: <http://tehnik.mobitel.si/10-nasvetov-za-dober-uporabniski-vmesnik-mandroid/> [Accessed 14 September 2010]. Slovenian language

Koch., P., 2010. *The Great WebKit Comparison Table*. [Online] (Updated August 2010.) Available at: <http://www.quirksmode.org/webkit.html> [Accessed 10 November 2010].

McCracken, H., 2008. *Smart Phone OS Smackdown*. [Online] (Updated November 21 2008)
Available at: http://www.pcworld.com/article/153503/smart_phone_os_smackdown.html
[Accessed 26 August 2010].

Microsoft., 2010. *Windows Phone 7*. [Online] (Updated n.d) Available at:
<http://www.microsoft.com/windowsphone/en-gb/default.aspx> [Accessed 19 November 2010].

Microsoft., 2010. *UI Design and Interaction Guide for Windows Phone 7 Series*. [Online] (Updated n.d) Available at: <http://download.microsoft.com/download/D/8/6/D869941E-455D-4882-A6B8-0DBCAA6AF2D4/UI%20Design%20and%20Interaction%20Guide%20for%20Windows%20Phone%207%20Series.pdf> [Accessed 20 November 2010].

Mies, G., 2010. *HTC's New Smartphones and Sense User Interface*. [Online] (Updated February 16 2010)
Available at:
http://www.pcworld.com/article/189415/first_look_htcs_new_smartphones_and_sense_user_interface.html [Accessed 25 August 2010].

Palm Inc, 2010. *webOS*. [Online] (Updated n.d) Available at:
<http://www.palm.com/uk/en/products/phones/pre2/index.html#tab3> [Accessed 17 November 2010].

Pettinati, L., 2007. *Challenges of Interface Design for Mobile Devices*. [Online] (Updated October 2 2007) Available at: <http://www.yuiblog.com/blog/2007/10/02/challenges-of-interface-design-for-mobile-devices/> [Accessed 8 July 2010].

Research In Motion Limited, 2010. *BlackBerry 6*. [Online] (Updated n.d) Available at:
<http://uk.blackberry.com/services/blackberry6/> [Accessed 21 November 2010].

Symbian Foundation, 2010. *The Symbian Foundation Community*. [Online] (Updated n.d) Available at: <http://www.symbian.org/> [Accessed 16 November 2010].

The Nielsen Company, 2010. *U.S. Smartphone Battle Heats Up: Which is the "Most Desired" Operating System?*. [Online] (Updated December 1 2010) Available at: http://blog.nielsen.com/nielsenwire/online_mobile/us-smartphone-battle-heats-up/ [Accessed 1 December 2010].

The WebKit Open Source Project, n.d. *The Great WebKit Comparison Table*. [Online] (Updated n.d.) Available at: <http://webkit.org/> [Accessed 17 November 2010].

Whitwam, R., 2010. *The State of the Modern Smartphone User Interface*. [Online] (Updated May 27 2010) Available at: <http://www.tested.com/news/the-state-of-the-modern-smartphone-user-interface/347/> [Accessed 11 November 2010].

Williams, A., 2010. *"Smart Phone" is a Misnomer: It's a Computer, not a Phone*. [Online] (Updated n.d) Available at: <http://www.readwriteweb.com/enterprise/2010/01/smart-phones-smart-phones-all.php> [Accessed 21 October 2010].

Bibliography

Fling, B., 2009. *Mobile Design and Development: Practical concepts and techniques for creating mobile sites and web apps*. Sebastopol: O`Reilly Media

Warner, J., LaFontaine, J., 2010. *Mobile Web Design for Dummies*. Indianapolis: Wiley Publishing, Inc.

Apple Inc., 2010. *iOS Human Interface Guidelines*. [Online] (Updated November 15 2010) Available at: <http://developer.apple.com/library/ios/#documentation/UserExperience/Conceptual/MobileHIG/Introduction/Introduction.html> [Accessed 29 November 2010].

Anon., n.d. *Buyers' Guide: How to Choose the Best Smartphone*. [Online] (Updated n.d) Available at: <http://www.broadbandgenie.co.uk/smartphones/> [Accessed 26 October 2010].

Anon., 2007. *7 usability guidelines for websites on mobile devices*. [Online] (Updated n.d.) Available at: <http://www.webcredible.co.uk/user-friendly-resources/web-usability/mobile-guidelines.shtml> [Accessed 10 July 2010].

Anon., 2010. *Web Designed to Accommodate the Smartphone User*. [Online] (Updated January 09 2010) Available at: <http://www.best-web-site-designers.com/index.php/2010/01/09/web-designed-to-accommodate-the-smartphone-user/> [Accessed 17 September 2010].

Dawson., A., 2010. *A Study of Trends in Mobile Design*. [Online] (Updated December 2 2010) Available at: <http://www.smashingmagazine.com/2010/12/02/a-study-of-trends-in-mobile-design/> [Accessed 2 December 2010].

DeBold, V., 2007. *Make your Site Mobile Friendly*. [Online] (Updated May 14 2007) Available at: <http://thinkvitamin.com/design/make-your-site-mobile-friendly/> [Accessed 15 August 2010].

Etemad, E., Newth, D. Jorunn, 2004. *Pocket-Sized Design: Taking Your Website to the Small Screen*. [Online] (Updated August 31 2004) Available at: <http://www.alistapart.com/articles/pocket/> [Accessed 12 June 2010].

Etheredge, D., 2010. *Website Design for Smartphones – Part 1*. [Online] (Updated February 15 2010) Available at: <http://blog.savvydog.com/?p=60> [Accessed 4 October 2010].

Etheredge, D., 2010. *Website Design for Smartphones – Part 2*. [Online] (Updated February 15 2010) Available at: <http://blog.savvydog.com/?p=221> [Accessed 4 October 2010].

Etheredge, D., 2010. *Website Design for Smartphones – Part 3*. [Online] (Updated February 15 2010) Available at: <http://blog.savvydog.com/?p=223> [Accessed 4 October 2010].

Gartner Inc., 2010. *Gartner Says Worldwide Mobile Phone Sales Grew 35 Percent in Third Quarter 2010; Smartphone Sales Increased 96 Percent*. [Online] (Updated 10 November 2010) Available at: <http://www.gartner.com/it/page.jsp?id=1466313> [Accessed 26 November 2010].

Gohring, N., 2006. *W3C: How to design for mobile devices*. [Online] (Updated June 27 2006) Available at: <http://www.infoworld.com/d/networking/w3c-how-design-mobile-devices-155> [Accessed 4 August 2010].

Mills, C., 2008. *Coding for the mobile web*. [Online] (Updated March 05 2008) Available at: <http://thinkvitamin.com/mobile/coding-for-the-mobile-web/> [Accessed 15 August 2010].

Moll, C., 2005. *Mobile Web Design ~ The Series*. [Online] (Updated July 26 2005) Available at: <http://www.cameronmoll.com/archives/000398.html> [Accessed 10 June 2010].

Picknäs, M., 2009. *Touchscreens taking over smartphone design*. [Online] (Updated August 18 2009) Available at: <http://news.techworld.com/mobile-wireless/121519/touchscreens-taking-over-smartphone-design/> [Accessed 8 October 2010].

Reyes, J., n.d. *5 Can't-Miss Usability Tips for Mobile Website Designs*. [Online] (Updated n.d.) Available at: <http://spyrestudios.com/usability-tips-for-mobile-website-designs/> [Accessed 26 September 2010].

Shinder, L., D., 2010. *Smartphone form factor's impact on Usability and User Satisfaction*. [Online] (Updated November 1 2010) Available at: <http://www.usabilitynews.com/news/article6959.asp> [Accessed 23 November 2010].

Snell, S., 2009. *Mobile Web Design Trends For 2009*. [Online] (Updated January 13 2009) Available at: <http://www.smashingmagazine.com/2009/01/13/mobile-web-design-trends-2009/> [Accessed 7 June 2010].

Stemkoski, R., 2009. *How to Design Websites for Mobile Phones*. [Online] (Updated January 1 2009) Available at: <http://www.stemkoski.com/how-to-design-websites-for-mobile-phones/> [Accessed 9 June 2010].

Tognazzini, B., 2007. *The iPhone User Experience: A First Look*. [Online] (Updated July 27 2007) Available at: <http://www.asktog.com/columns/070iPhoneFirstLook.html> [Accessed 6 September 2010].

Vidani, P., n.d. *Mobile Design UK*. [Online] (Updated n.d.) Available at: <http://mobiledesign.org.uk/> [Accessed 2 October 2010].

X., A., n.d. *The Need for a Smartphone*. [Online] (Updated n.d) Available at: <http://www.buzzle.com/articles/the-need-for-a-smartphone.html> [Accessed 24 November 2010].

Yadav., S., 2010. *In the mobile world, it is all about the user experience*. [Online] (Updated March 21 2010) Available at: <http://sachendra.wordpress.com/2010/03/21/in-the-mobile-world-it-is-all-about-the-user-experience/> [Accessed 11 November 2010].

YousefIssa., n.d. *How Will Smartphone Web site Design change from standard web site design and style?*. [Online] (Updated n.d) Available at: <http://hubpages.com/hub/How-Will-Smartphone-Web-site-Design-change-from-standard-web-site-design-and-style> [Accessed 19 October 2010].

Appendix

User Interface screenshots



Stock Android



SENSE UI Android Interface



MOTOBLUR Android Interface



iOS 4.2



webOS 2.0



BlackBerry OS 6



Symbian OS